REMARKS

Claims 1-18, 22-24, 27-46, 51 and 53-87 are pending, and claims 1-15, 31-39 and 58-87 are withdrawn from consideration.

I. Rejections Under 35 U.S.C. §103(a)

A. Niu in view of Ito

Claims 16-18, 22-24, 27-30, 40-46, 51 and 53-57 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Publication No. 2002/0008956 ("Niu") in view of WO 2002/45113 ("Ito"). This rejection is respectfully traversed.

The Patent Office alleges that Niu teaches forming a structure comprised of crosslinked carbon nanotubes. The Patent Office admitted that Niu does not teach or suggest dry etching to pattern the crosslinked carbon nanotubes, or the formation of a resin resist layer, as required in the present claims. The Patent Office alleged that Ito remedies this deficiency by teaching the formation of a resin resist layer, and dry etching to pattern the crosslinked carbon nanotubes. Applicants disagree.

Specifically, the Patent Office alleged that Ito teaches a photoresist layer, which is deposited onto the aluminum mask and then exposed and developed.

However, the method of Ito does not teach or suggest the patterning step using a resin resist recited in claims 16 and 41. Ito teaches forming an aluminum film that is to serve as a mask on the carbon nanotube film, and then a resist is coated onto the aluminum film for patterning. See paragraph [0107] of Ito. The resist of Ito is utilized to pattern the aluminum film, not the carbon nanotube structure layer as in claims 16 and 41. The resist is then stripped away, and the carbon nanotube film is etched using the aluminum film as the mask. See paragraphs [0110]-[0111] of Ito. However, if the resist layer is not stripped away, the resist will be removed during the dry etching process. See paragraph [0127] of Ito.

Thus, Ito uses a patterned aluminum film for patterning of a carbon nanotube film. The resist layer in Ito is removed before or at the same time the carbon nanotube film is patterned by dry etching using the patterned aluminum film. In other words, the resist layer cannot be used to pattern the carbon nanotube film as recited in the present claims because according to the teachings of Ito, it is removed during the dry etching step. The resist layer in Ito is not used to pattern the carbon nanotube structure layer into a desired shape as required in claims 16 and 41.

Niu and Ito, in combination or alone, do not teach or suggest the step of patterning the carbon nanotube structure layer into a desired shape wherein the patterning step is a resist layer forming step of forming a resin resist layer on a region of the carbon nanotube structure layer on the temporary substrate surface that is to be patterned into a desired shape; and a removal step of removing the exposed portions of the carbon nanotube structure layer that are not covered with the resist layer by dry etching (claim 16) or a removal step for bringing an etchant into contact with a side of the temporary substrate where the carbon nanotube structure layer and the resist layer are layered, thereby removing the carbon nanotube structure layer from the exposed regions that are not covered with the resist layer (claim 41).

For the foregoing reasons, Niu and Ito, in combination or alone, do not teach or suggest all of the features recited in claims 16-18, 22-24, 27-30, 40-46, 51 and 53-57. Reconsideration and withdrawal of the rejection are thus respectfully requested.

B. Niu in view of Ito and French

Claims 16-18, 22-24, 27-30, 40-46, 51 and 53-57 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Niu in view of Ito and further in view of U.S. Publication No. 2004/0038556 ("French"). This rejection is respectfully traversed.

The Patent Office alternatively alleges that if Ito does not teach or suggest a resin resist, then it would have been obvious to substitute Ito's metal mask with a resin resist layer

as taught by French to pattern a carbon nanotube film. French allegedly teaches that a resist or a mask may be made of a polymer. See, for example, paragraphs [0129], [0134] and [0315] of French. Applicants disagree with the Patent Office's assertions.

Like Niu and Ito, French also does not teach or suggest a method of manufacturing a carbon nanotube structure, comprising (1) patterning the carbon nanotube structure layer into a desired shape (a patterning step) wherein the patterning step is a resist layer forming step of forming a resin resist layer on the region of the carbon nanotube structure layer on the base body surface that is to be patterned into a desired shape; and a removal step of removing the exposed portions of the carbon nanotube structure layer that are not covered with the resist layer by dry etching, as recited in claim 16, or (2) patterning the carbon nanotube structure layer into a desired shape wherein the patterning step is a resist layer forming step of forming a resin resist layer on a region of the carbon nanotube structure layer on the temporary substrate surface that is to be patterned into a desired shape; and a removal step for bringing an etchant into contact with a side of the temporary substrate where the carbon nanotube structure layer and the resist layer are layered, thereby removing the carbon nanotube structure layer from the exposed regions that are not covered with the resist layer; and transferring the patterned carbon nanotube structure layer to a base body, as recited in claim 41.

French describes that the dispersant solution, in which the nano-structures or nanotubes are dispersed, is spread and layered on the surface of the solid substrate. See paragraph [0158] of French. This layer is then covered with a photoresist polymer and patterned. Subsequently, cutting is accomplished by electron irradiation, photon irradiation, ion-beam irradiation, or plasma ionization. See paragraph [0162] of French

In paragraph [0110], French describes that the term "nano-structure" means tubes, rods, cylinders, bundles, wafers, disks, sheets, plates, planes, cones, slivers, granules,

ellipsoids, wedges, polymeric fibers, natural fibers, and other such objects which have at least one characteristic dimension less than about 100 microns. That is, French uses the term "nano-structure or nanotube" to represent a minute structure. The population of nano-structures is disposed on the surface of the substrate (see, for example, claim 1 and paragraph [0148] of French). However, French does not teach or suggest a structure in which carbon nanotubes are chemically bonded with each other, as recited in the present claims.

For example, the resultant structure obtained by dispersing the population of nano-structures in the dispersant liquid or a polymer (paragraphs [0149] and [0150]) is coated, layered, and as described above, covered with the photopolymer. Thus, when the photopolymer is applied, the nano-structures flow together with the photopolymer, with the result that it is difficult to achieve the desired shape. Further, when the resultant structure obtained by dispersing the population of nano-structures in the polymer is layered, the nano-structures do not flow through the application of the photoresist. However, there is employed a structure in which the polymer intervenes between the nanotubes. Thus, an interconnected structure cannot be constructed.

In other words, the photopolymer disclosed by French is not a resin resist as recited in the present claims because the photopolymer of French does not permeate into the crosslinked structure of the nanotubes, as does the resin resist recited in the present claims, and as more fully described below.

The carbon nanotube structure of the present claims has a structure such that inter-crosslinking is performed, and a resin is caused to permeate into the inside of holes of the network structure. Further, the structure is patterned. Thus, the flow of the nano-structures through the application of the photoresist is inhibited. In addition, the resin that permeates into the inside of the holes prevents the immersion of plasma to the inside of the network

structure in oxygen plasma ashing. Thus, the patterned structure can be obtained as recited in claims 16 and 41.

The metal mask of Ito has a structure in which, in oxygen plasma ashing, oxygen plasma is immersed in voids formed in membranes of nanotubes which are entangled with each other, and the nanotube membrane is reduced in size. Niu describes the nanotube structure in which nanotubes are chemically bonded with each other, but never describes the patterning owing to plasma ashing. In French, the photoresist is applied to the layer of the nano-structure, so the nanotube structure in which nanotubes are bonded with each other are not formed, and the patterning achieving the desired shape is not performed.

In other words, (a) when the population nanotube is patterned simply, the application of a photoresist has difficulty in patterning the desired shape, (b) when the resin resist is not applied and plasma ashing is performed using a metal mask, oxygen plasma is immersed in the network of the carbon nanotube, and the nanotube is burned and reduced in size or disappeared, to thereby have difficulty in patterning the desired shape, and (c) when the carbon nanotube membrane dispersed in the polymer in order to obtain a correct shape is processed by photolithography; the formed membrane does not have a structure in which carbon nanotubes are connected with each other. Unlike the combination of Niu, Ito and French, the structure recited in the present claims can simultaneously solve the problems (a) to (c).

For at least the foregoing reasons, Niu, Ito and French, in combination or alone, do not teach or suggest all of the features recited in claims 16-18, 22-24, 27-30, 40-46, 51 and 53-57. Reconsideration and withdrawal of the rejection are thus respectfully requested.

C. Horiuchi in view of Ito

Claims 16-18, 22-24, 27-29, 40-46 and 53-56 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Publication No. 2002/0122765 ("Horiuchi") in view of Ito. This rejection is respectfully traversed.

The Patent Office alleges that Horiuchi teaches forming a structure comprised of crosslinked carbon nanotubes. The Patent Office admitted that Horiuchi does not teach or suggest dry etching to pattern the crosslinked carbon nanotubes, or the formation of a resin resist layer, as required in the present claims. The Patent Office alleged that Ito remedies this deficiency by teaching the formation of a resin resist layer, and dry etching to pattern the crosslinked carbon nanotubes. Applicants disagree.

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Ito is not used to pattern the carbon nanotube structure layer into a desired shape as required in claims 16 and 41.

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The Patent Office alternatively alleges that if Ito does not teach or suggest a resin resist, then it would have been obvious to substitute Ito's metal mask with a resin resist layer as taught by French to pattern a carbon nanotube film. French allegedly teaches that a resist or a mask may be made of a polymer. See, for example, paragraphs [0129], [0134] and [0315] of French. Applicants disagree with the Patent Office's assertions.

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For example, the resultant structure obtained by dispersing the population of nano-structures in the dispersant liquid or a polymer (paragraphs [0149] and [0150]) is coated, layered, and as described above, covered with the photopolymer. Thus, when the photopolymer is applied, the nano-structures flow together with the photopolymer, with the result that it is difficult to achieve the desired shape. Further, when the resultant structure obtained by dispersing the population of nano-structures in the polymer is layered, the nano-structures do not flow through the application of the photoresist. However, there is employed a structure in which the polymer intervenes between the nanotubes. Thus, an interconnected structure cannot be constructed.

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each other, and the nanotube membrane is reduced in size. Horiuchi describes the nanotube structure in which nanotubes are chemically bonded with each other, but never describes the patterning owing to plasma ashing. In French, the photoresist is applied to the layer of the nano-structure, so the nanotube structure in which nanotubes are bonded with each other are not formed, and the patterning achieving the desired shape is not performed.

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For at least the foregoing reasons, Horiuchi, Ito and French, in combination or alone, do not teach or suggest all of the features recited in claims 16-18, 22-24, 27-29, 40-46 and 53-56. Reconsideration and withdrawal of the rejection are thus respectfully requested.

II. Rejoinder

Applicants submit that upon allowance of the elected claims, claims 1-15, 31-39 and 58-87 should be rejoined with the application and similarly allowed.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-18, 22-24, 27-46, 51 and 53-87 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

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